

## Nesting Habits and Larva of *Pulverro monticola*

(Hymenoptera: Sphecidae)

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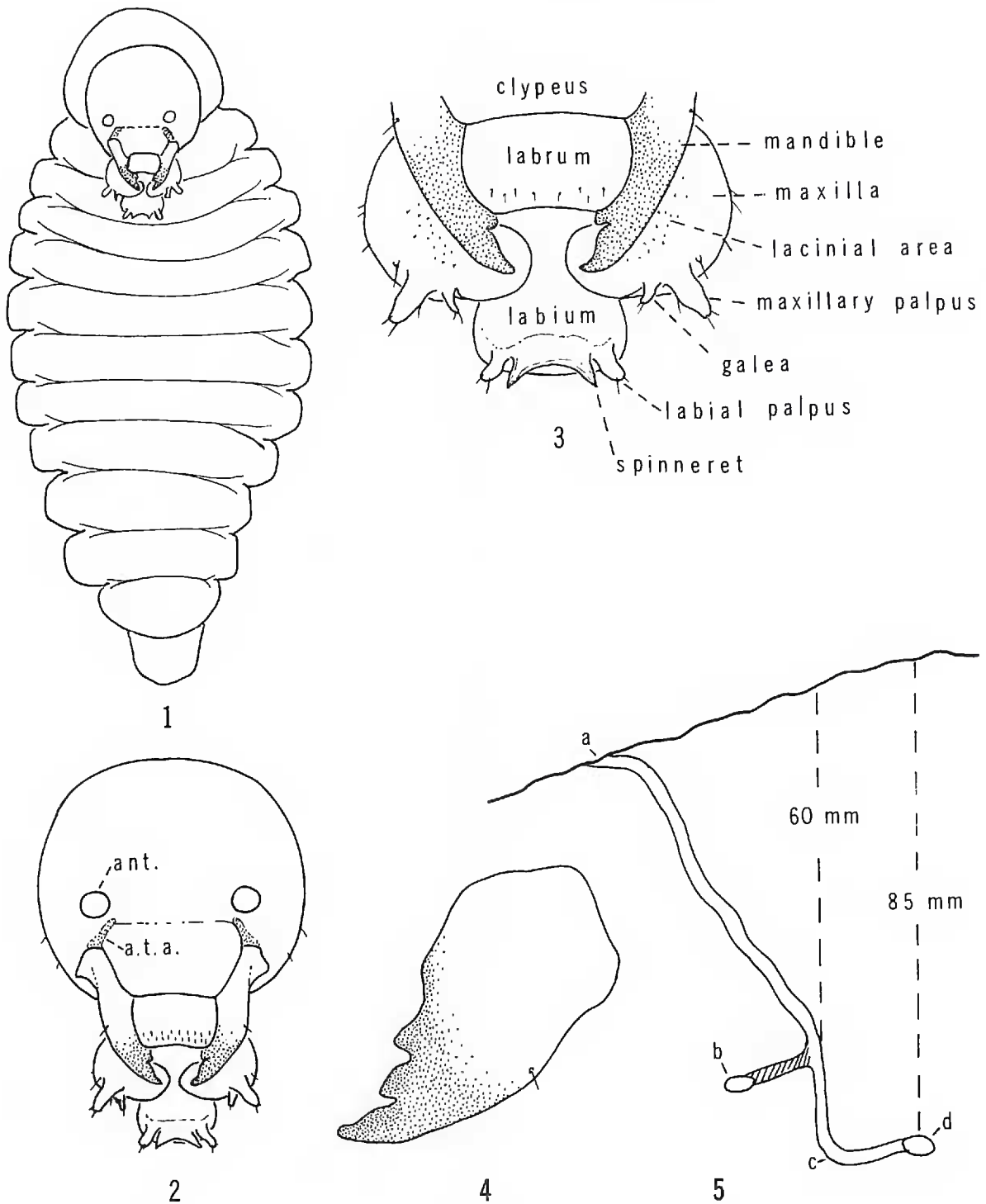
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*Pulverro* Pate is a nearctic genus with seven described species. Nothing has been published about its biology and very little about that of related genera such as *Ammoplanops* and *Ammoplanus*. No doubt the small size of these wasps has helped them avoid observation. The somewhat related genus *Microstigmus* is known to take Collembola or Thysanoptera as prey, so it is not surprising that thrips are used by *Pulverro*.

The nesting site of *Pulverro monticola* Eighme was first observed in July 1968. A detailed study was made in July 1970 and some additional work was done in the summer of 1971. Many nest entrances were found in the side banks along 400 m of dirt logging road near the Sagehen Creek Biological Station of the University of California at an altitude of about 6,500 feet in Nevada County, California. To some extent the nests were grouped, with 15 to 20 in a square meter area, and the entrances were sometimes only a few mm apart. On the other hand some nests were rather isolated or scattered along the roadside. The following description of our primary study area will serve to characterize other sites used by *P. monticola*. The roadside mound was about 0.5 m high and covered nearly 2.0 m<sup>2</sup>. The soil was fine grained intermixed with many small pebbles and a few stones up to 15 or 20 cm in length. Surface features included several larger rocks, a few broken branches, and the remains of a small stump. The mound was sparsely clothed in *Lepidium* about 15 cm tall. From 1 to 24 July 1970 we located 32 nests in the mound some of which were started as late as 24 July. The season was considerably retarded by cold weather in 1971 and the nesting period was advanced to the approximate period of 15 July to 7 August.

During the middle of the nesting season, nest activity began about 8:45 a.m. Pacific Standard Time as the sun struck the east slope of the mound and ceased about 4:00 p.m. as sunlight left the west slope. Female *Pulverro* nesting on the east slope were active about an hour earlier in the morning and stopped about an hour earlier in the afternoon than those on the west slope.

Daily activity began as the female wasp emerged head first and remained for a few minutes in the sunlight near the entrance. A



FIGS. 1-4. Prepupal larva of *Pulverro monticola* Eigme, ventral views. FIG. 1. Whole larva. FIG. 2. Head enlarged; ant. = antennal orbit, a.t.a. = anterior tentorial arm. FIG. 3. Mouthpart area enlarged. FIG. 4. Mandible. FIG. 5. Vertical section through a nest of *P. monticola*; a, entrance on ground slope; b, completed cell sealed off by a dirt plug; c, bend in burrow where loose thrips were found; d, nearly complete cell.

vigorous cleaning activity then began in which the wasp went head first into the nest, kicked out small dirt particles with her legs and dragged out larger particles in her mandibles. This material accumulated on the slope immediately beneath the entrance and was some-

times distributed somewhat by the wasp. This tumulus served as a convenient marker for the nest entrance just above it.

Underground morphology of the burrows was determined by excavation of about 20 of them. This process was extremely difficult and often unsuccessful because of the small burrow diameter (about 2 mm) and the rock and stick inclusions in the soil. Plaster of Paris, both dry and in dilute suspension, was pipetted into the burrows to aid in tracing them. This helped considerably but the uneven soil texture still created problems. Finally, earth at several sites was sifted before the nesting season in June 1971. The resulting fine and even grained soil was used by several *Pulverro* in July of the same year. Excavation of these nests in early August 1971 was fairly successful. One nest followed in its entirety appeared to be typical. Its directions and dimensions are shown in Figure 5. The burrow was briefly horizontal, then curved downward to a depth of about 85 mm. At the 60 mm level a short side burrow, plugged with dirt, led to an indistinct cell containing 21 thrips, the agglutinated remains of about 12 more thrips, and a half-grown wasp larva (Fig. 5b). At the 85 mm level four thrips were lodged loosely in a bend of the burrow (Fig. 5c). A cell at the end of the short unplugged side burrow which followed contained 28 thrips but no egg or larva (Fig. 5d). Judging from several excavations, the wasp may deposit thrips temporarily at a bend opposite the cell, and move them to the cell later. This idea fits well with the provisioning observations described below.

Prior to provisioning, wasps of both sexes were abundant on flowers of several sorts, particularly those with a short corolla. Examples were *Potentilla gracilis* Dougl. ex Hook., *Calyptridium umbellatum* (Torr.) Greene, *Nama lobbii* Gray, *Phacelia* species, *Chamaesaracha nana* (Gray) Gray, and *Ligusticum* species. Males could be found at flowers for about two weeks after the onset of nesting, but copulation was not observed. Provisioning females presumably collected their prey on the same flowers. Furthermore, they were observed to crawl down the corollas of *Penstemon gracilentus* Gray, apparently in search of prey. Female wasps were first seen provisioning on 4 July 1970. Thrips were carried singly, venter uppermost and held in the mandibles of the wasp. Each thrips was grasped by the thorax with its head projecting anteriorly from the wasp's mandibles, and the rest of the thrips lying under the thorax of the wasp. When a wasp was captured in an aspirator, it walked readily about the tube without using its legs to hold the prey. The provisioning female hovers briefly about its nest and then enters directly without alighting.

Ordinarily the wasp deposits its prey and emerges in 10 to 40 seconds. However, several timings were as short as three to five seconds. We presume that in these instances the female merely dropped her thrips at a bend in the burrow, as suggested above. On leaving the burrow a female waits momentarily with her head at the entrance, then walks back and forth in front of the entrance, pauses, and flies around in several erratic circles before disappearing. Time recorded for searching during mid day varied from 40 seconds to six minutes, with about two minutes on the average, based on 30 observations and five wasps.

Prey of *Pulverro monticola* appears to be mostly adult thrips but occasionally a few large immatures are included in the provisions. Observed Thysanoptera were *Frankliniella moultoni* Hood and a few specimens of *Aeolothrips fasciatus* (Linnaeus). Both of these were abundant on flowers in the vicinity.

Judging from the observation of many nests, the entrances are never closed by the wasp while she is absent in search of thrips or after the nest is complete. This is in agreement with the fact that female *Pulverro* have the tarsal rake undeveloped. The entrance is thus frequently exposed to predators and parasites. Ants of various sizes have been seen in fair numbers on the nesting site but even those small enough to enter the burrows have not done so. No sarcophagid flies have been noted. All of the nyssonine parasites and most of the chrysidids which visited the site were too large to enter the burrows. One minute species of *Hedychridium* was seen to inspect the nests and could conceivably be a parasite of *Pulverro*. Soon after nesting is completed, the burrow entrances are partially blocked by wind blown dust and doubtless they are eventually sealed off by rains.

In one of the excavations a prepupa was found. It was in a silken cocoon at a depth of about 80 mm. The cocoon was egg-shaped, 2.75 mm long and 0.85 mm at its greatest breadth. The outer surface of the cocoon was covered with sand grains and parts of thrips. The prepupa was 2.5 mm long and 0.8 mm wide. It was subsequently sketched while still alive, then partially cleared and mounted on a slide for microscopic examination. Details are given in Figures 1-4. Essential features of the larva are as follows: (1) body fusiform rather than cylindrical, largely smooth, a few scattered microsetae including some on mouthparts; (2) head capsule 0.40 mm long, 0.44 mm wide; (3) antennal orbits and frontoclypeal suture not distinct, mouthparts pigmented only toward apex of mandible; (4) labrum

weakly emarginate apically, bearing about 10 scattered microsetae; (5) mandible with four teeth including a weak basal one, a single bristle near middle of outer margin; (6) maxilla largely asetose but with scattered spicules in lacinial area, maxillary palpus stout and much larger than galea; (7) spinnerets acute apically, not connected by a membrane and not exceeding labial palpi.

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### SCIENTIFIC NOTE

**A host record for *Fedtschenkia* (Hymenoptera: Sapygidae).**—The genus *Fedtschenkia* occurs in both western North America and in palearctic Asia. There has been some question as to its affinities since it resembles certain Scoliidae, such as *Cosila*, but male genitalia and other features place it in the Sapygidae. There has long been speculation about the identity of its host. All other known hosts of sapygids are bees, particularly megachilids but also xylocopids.

In 1956 at Tanbark Flat in the San Gabriel mountains of California the senior author observed a female *Fedtschenkia anthracina* (Ashmead) entering a ground burrow which was found to contain a cell with a dead adult of the eumenid wasp, *Pterocheilus trichogaster* R. Bohart. Evidence of a relationship seemed flimsy until D. J. Horning and the junior author excavated a number of burrows of *P. trichogaster* on Santa Cruz Island, California late in April of 1969. *Fedtschenkia* were abundant and active as parasites in the nesting area. Finally, the senior author at Arroyo Seco, Monterey County, California in May 1971 observed *F. anthracina* females entering and staying for considerable periods in burrows of *P. trichogaster* which were provisioning with geometrids of the genus *Hydriomena* Hübner (det. M. R. Gardner).—R. M. BOHART AND R. O. SCHUSTER, *Department of Entomology, University of California, Davis, 95616.*

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